

**REMARKS****Rejection of Claims and Traversal Thereof**

In the December 18, 2002 Office Action:

claims 57-58 were rejected under 35 U.S.C. §112, first paragraph;

claims 21, 26-27, 57-58 and 61 were rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 5,405,590 issued to Macado, et al.;

claims 21, 26-27 and 55-58 and 61 were rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 4,147,756 issued to Dahlstrom, et al.; and

claims 21, 26-27 and 51-54, 57-58 and 61 were rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 6,019,818 issued to Knapp.

These rejections are hereby traversed in respect of the pending claims 21, 26-27, 51-54, 57-58 and 61.

Reconsideration of the patentability of the pending claims is therefore requested in light of the following remarks.

**Rejection under 35 U.S.C. § 112, first paragraph**

In the June 3, 2003 Office Action, claims 57-58 were rejected under 35 U.S.C. §112, first paragraph. Applicants have amended claims 57-58, thereby obviating this rejection under 35 U.S.C. 112, first paragraph. Withdrawal of this rejection is respectfully requested.

**Rejection under 35 U.S.C. 103(a)**

All the currently pending claims were rejected under 35 U.S.C. §103(a) as being unpatentable over three references including Macado, et al., Dahlstrom, et al., and Knapp. These references were not combined but each one cited individually against the claims. Applicants traverse these rejections

and submit that none of the cited references render applicants' claimed invention *prima facie* obvious.

As stated numerous times, the presently claimed invention relates to an abatement system that comprises a first scrubbing unit wherein the effluent gas is flowed co-currently with a scrubbing liquid to remove gases and solids. From the first stage scrubber unit, the partially treated gas flows to a second stage scrubber unit. The second scrubbing unit has a smaller diameter than the first stage scrubber unit. The smaller size of the second scrubbing unit, due to the smaller volume constraints, enables proper wetting with a lower water flow rate. Most preferably, the diameter of the second scrubbing unit is about one fifth the diameter of the first scrubbing unit. Further, the efficiency of the two-stage scrubber is high and allows the system to operate without using chemical injection agents and/or large amounts of fresh water.

The Office admits that none of the cited references discloses a second scrubbing unit that is smaller than the first scrubbing unit. However, the Office contends that the cited references teach a two stage scrubbing system and that it would have been obvious to one having ordinary skill in the art to optimize the size of the scrubber units to obtain the best results. Applicants do not agree with the Office that the presently claimed abatement process is the result of obvious experimentation, since such experimentation would not have come from within the teachings of any of the cited references.

Applicants remind the Office that to meet its burden of establishing a *prima facie* case of obviousness, the Office must provide some suggestion, found in the prior art, to modify and reconfigure the scrubbing systems of the prior art according to the presently claimed invention. This will be very difficult in light of the fact that the Office has already admitted that the cited references do not address the size of the second scrubbing unit.

Further, applicants submit that none of the cited references provides incentive to go in the direction of applicants' claimed invention. For example, Dahlstrom, et al. clearly states at column 4, lines 63-68, that:

"It should be understood that the design and structure of the scrubbing device 51 is well known and does not constitute a part of the instant invention; the scrubbing 51 could alternatively comprise a venturi scrubbing device, a spray tower, or a perforated-plate type of liquid-gas contacting device."

Thus, it is evident that there is no guidance in Dahlstrom, et al. to change the second scrubber, to improve performance or optimize the system especially because it is very clear that according to Dahlstrom, et al. any scrubbing system can be used to perform the required duty. The Office has not highlighted any text in the Dahlstrom, et al. reference that would indicate that the second scrubber could or should be changed. Clearly, the size of the second scrubber in the Dahlstrom, et al. system is never addressed or discussed.

The Macado, et al. reference has only one goal and that is to keep the volume of the scrubber solution fixed so there will be no secondary waste generated during scrubbing. Macado, et al., at column 2, lines 50-58, describes an adaptive method to maintain a constant level of liquid in the system by stating that:

“[I]f the volume of the scrubbing solution starts to increase because of a high rate of condensation of the incoming exhaust gases, then less heat is removed from the scrubber solution to allow for more evaporation from the secondary scrubber. In contrast, if the volume of the scrubber solution starts to decrease, more heat is removed from the scrubber solution to allow for higher condensation of incoming exhaust into the secondary scrubber.”

The Macado, et al. system provides no guidance regarding the size of the secondary scrubber. Moreover, the size of the scrubber is not important to the described invention because as stated in column 3, lines 6-7, “the goal is to keep the total volume of scrubbing solutions fixed no matter how many scrubbers are being used.” Clearly, Macado, et al. does not teach or suggest that the size of the secondary scrubber is an important aspect of the invention, nor would one skilled in the art consider that the Macado, et al. system suffered from any shortcomings that required modification.

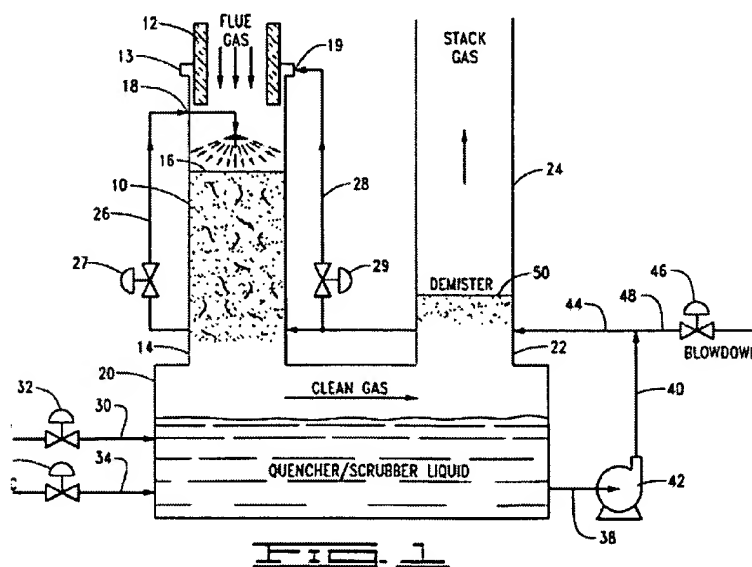
Knapp describes a single downflow apparatus which functions both as a quencher and a packed bed scrubber wherein the contaminated gas is cooled and contaminants removed simultaneously. In column 3, lines 8-10, the Knapp reference make one single statement about the addition of a polishing scrubber to further purify the gaseous products. Specifically the statement recites:

**"if desired, a polishing scrubber may be used to further purify the gaseous products."**

The Office proposes that this one statement in Knapp is sufficient to establish a *prima facie* case of obviousness. However, there is no discussion in Knapp as to where this proposed polishing

scrubber should be located or whether this proposed polishing scrubber includes a scrubbing liquid. The Office cannot speculate on the specifics of the possible polishing column without some guidance from the reference.

The Office has responded in the June 3, 2003 Office Action by stating that “even though the polishing column is not located in the drawings of Knapp, ...*the polishing scrubber must be located after the first scrubber column*” (emphasis added). Applicants submit that this speculative statement is incredulous and it certainly does not meet the required standards for establishing a *prima facie* case of obviousness. The Office contends that although the Knapp reference does not describe the placement, size, or type of secondary scrubber, a few words mentioned in Knapp about a polishing column is sufficient to provide guidance to go in the direction of applicants’ claimed invention. Applicants vigorously disagree and submit that merely viewing Figure 1 of Knapp, recreated below for ease of reference, one skilled in the art can clearly see that there is no area in the system for a secondary scrubber between the first scrubber and the demister.



As stated by Knapp, in column 5, lines 33-40:

“The flue gas entering column 10 through entry 12 is simultaneously quenched and cleaned by packed bed 16. The cooled and cleaned gas leaving column 10 via exit 14 is passed through an appropriate device, such as a demister 50, to remove the droplets of quencher/scrubber liquid that are usually entrained in the clean gas as a result of the liquid cleaning process.”

Thus, although Knapp explicitly states that the cleaned gas is passed into the demister 50 for drying of the cleaned gas, the Office speculates that somewhere in the above system, the polishing scrubber will be positioned. Notably, the specific type of polishing scrubber is not disclosed in Knapp. The polishing scrubber could be located after the demister, but does that mean another demister will have to be added to the Knapp system to once again remove liquid from the gas exhaust, if the polishing column uses a wet scrubber system? Applicants remind the Office that the burden of proof to establish obviousness does not include speculation by the Office but instead must be found in the cited references. The Office seems to be merely reinterpreting the prior art in light of applicants' disclosure, in order to reconstruct applicants' claimed invention, but without any instructional or motivating basis in the reference itself. Such approach is improper and legally insufficient to establish any *prima facie* case of obviousness.

Interestingly the Office has cited three references but none of the references describe a secondary scrubber system that is smaller than the first scrubber. Applicants question if the presently claimed invention is so obvious, why the Office is unable to locate a single reference that describes altering the size of the secondary scrubber? Certainly Knapp (2000), was aware of both the Macedo, et al (1995) and Dahlstrom, et al. (1979) systems but did not recognize the importance of a secondary scrubber sized to improve performance. Likewise, Macedo, et al, was certainly aware of the Dahlstrom, et al. system but did not go in the direction of applicants' claimed invention. Clearly it is not obvious from Dahlstrom, et al. or any of the later references to construct a system wherein the secondary scrubber is sized smaller than the primary scrubber. As stated numerous times, the Office must be alert not to read obviousness into an invention on the basis of applicants' own statements. *In re Spinnoble*, 160 USPQ2d 237 (CCPA 1969).

For judging patentability, the Office must view the claimed invention in light of the state of the art at the time of filing. As the Court stated in *Interconnect Planning Corp v. Feil*, 227 USPQ 543 (Fed. Cir. 1985), "[t]he invention must be viewed not with the blueprint drawn by the inventor, but in the state of the art that existed at the time" (emphasis added). The state of the art existing at the time of the filing of the present application included systems that did recognize the importance of effectively sizing a secondary scrubber to decrease the amount of make-up water for effective removal of contaminants from gaseous exhausts.

According to the Office:

“Applicants have not provided any evidence to show criticality or unexpected results for the use of a smaller second scrubbing units.”

Applicants remind the Office that none of the cited references provide any guidance regarding the size of the respective secondary scrubbing systems, so a comparative analysis between the presently claimed system and those systems of the cited references is impossible. The Office contends that these references are the closest prior art but the disclosures provide no guidance regarding the individual respective systems. None of the cited references has provided any guidance as to which parameters are critical. Dahlstrom, et al. expressly states that **it does not matter what type of secondary scrubber is used.** Macado, et al. is concerned with **keeping the total volume of scrubbing solutions fixed no matter how many scrubbers are being used.** Finally, Knapp **does not show or give any guidance for a secondary scrubber** and instead uses a demister.

Applicants have included in the present specification a number of examples showing the benefits of the smaller secondary scrubber, as set forth at pages 46 and 47 of the present specification. The Office seems to be ignoring this data by stating that applicants “has not provided any evidence to show criticality or unexpected results for the use of a smaller second scrubbing units.” **It is well settled in the law that the Office must consider comparative data set forth in the specification in determining whether the claimed invention provides unexpected results.** *In re Margolis*, 228 U.S.P.Q. 940 (Fed. Cir. 1986). **Applicants’ present specification contains specific data indicating surprising and unexpected results.** According to the Court in *In re Soni*, 34 U.S.P.Q.2d 1684 (Fed. Cir. 1995) all evidence of nonobviousness must be considered when assessing patentability, and the PTO **must consider comparative data in the specification** in determining whether the claimed invention provides unexpected results. The basic principal behind this rule is straightforward — that which would have been surprising to a person of ordinary skill in a particular art would not have been obvious.

The disclosure in the instant application underscores this point. For example, for a given make-up water flow rate, the 2-stage design will enable significantly higher scrubbing efficiencies. On the other hand, if a given efficiency is required, the 2-stage design allows for a significant reduction in the make-up water flow rate. Finally, the 2-stage arrangement allows the scrubber system to accept a higher gas challenge while maintaining the same efficiency and make-up water flow rate as compared to a single stage scrubber system.

In a representative comparison, of a prior art single-stage scrubber system, and a two-stage water scrubber system of the present invention, for scrubbing of fluorine gas, a nitrogen flow containing fluorine was treated by water scrubbing in the respective systems. The resulting performance data are shown in Table B below.

TABLE B

## Single-Stage Water Scrubber

| Make-up Water (GPM) | Total N2 (slpm) | Chem inject? | F2 inlet (slpm) | Equivalent Outlet(HF) (ppm) |
|---------------------|-----------------|--------------|-----------------|-----------------------------|
| 1.2                 | 80              | no           | 0.5             | 10.5                        |
| 1.2                 | 80              | yes          | 0.5             | 69.5                        |
| 0.5                 | 80              | yes          | 3.0             | 745.5                       |

## Two-Stage Water Scrubber

| Make-up Water (GPM) | Total N2 (slpm) | Chem inject? | F2 inlet (slpm) | Equivalent Outlet(HF) (ppm) |
|---------------------|-----------------|--------------|-----------------|-----------------------------|
| 0.75                | 80              | no           | 0.5             | 4.2                         |
| 0.75                | 80              | no           | 1.0             | 8.4                         |
| 0.75                | 80              | yes          | 2.25            | 2.5                         |
| 0.75                | 230             | yes          | 3.0             | 42.8                        |
| 0.75                | 230             | yes          | 5.0             | 98                          |

The foregoing data show the improvement of fluorine abatement and low water consumption requirements of the claimed two-stage water scrubber system of the present invention.

In a specific embodiment, the first stage of the 2-stage scrubber system comprises a packed column with a diameter of 21" and a height of 18", through which semiconductor process tool exhaust gases pass in a cocurrent fashion. The second stage column may have a diameter of 4" and a height of 18", permitting a much lower water flow rate to be used for scrubbing as compared to the first stage column. **This design is such that proper wetting of the packing can be achieved with a water flow rate of <0.5 GPM; fresh make-up water can therefore be used for this purpose**. The Office should take note of the low make-up water required and the effectiveness exhibited in the abatement of the gaseous product.

Figure 10 in the specification is a graph of improvement factor for the decrease of ammonia exhaust concentration when the polishing scrubber is used (in comparison to a corresponding system lacking the polishing scrubber), as a function of water flow rate, in gallons per minute. The graph shows that the polishing scrubber decreases the  $\text{NH}_3$  outlet concentration up to 110 times (in relation to a corresponding scrubber system wherein no polishing scrubber is present) for a given make-up water flow rate. Additionally, the polishing scrubber can decrease the  $\text{NH}_3$  outlet concentration up to a factor of 30 while using only 1/3 of the make-up water of a corresponding single stage scrubber system.

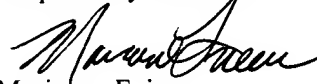
Thus, applicants have shown **unexpected results** obtained from using a smaller secondary scrubber and these results must be taken fully into account when determining obviousness, pursuant to Congressional mandate for consideration of invention “as a whole.” Moreover, there is no suggestion in any of the cited references that use of a secondary scrubber of a smaller size relative to the primary scrubber would have an overall effect in reducing make-up water but also increase efficiency of the scrubbing system.

In conclusion, and in light of the above discussion, applicants contend that the Office has not met its burden of establishing a *prima facie* case of obviousness. Accordingly, applicants respectfully request that the rejection of claims 21, 26-27, 51-54, 57-58 and 61 on the basis of obviousness, be withdrawn.

### **Conclusion**

The pending claims 21, 26-27, 51-54, 57-58/ and 61, as now amended, meet all disclosure requirements and patentably distinguish over the prior art, and in view of the forgoing remarks, it is respectfully requested that all rejections be withdrawn thereby placing the application in condition for allowance. Notice of the same is earnestly solicited. In the event that any issues remain, Examiner Nguyen is requested to contact the undersigned attorney at (919) 419-9350 to resolve same.

Respectfully submitted



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